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58 - 2 SCUBA DIVING AND STARFISH CONTROL

An explosive increase in the starfish population in Long Island Sound in 1957-1958 was of considerable concern to the commercial oyster growers in the area. The oystermen enlisted the aid of the Fish and Wildlife Service and the conservation agencies of the states of New York and Connecticut as the first step in a cooperative program for seeking a method to combat the starfish. Starfish are notorious predators of oysters and other bivalves and if left uncontrolled would soon deplete the oysters and financially ruin the oyster growers.

The cooperating agencies first wanted a measure of the relative efficiency of several methods presently in use for destroying starfish on oyster grounds. The methods involve the use of unslaked lime as a caustic agent, and mechanical devices which physically remove the starfish from the oyster bed. It was felt that the evaluation could best be carried out by SCUBA divers who could actually watch the control measures in operation.

Two biologists, trained as SCUBA divers, John P. Wise and Albert C. Jensen, from the NAFI staff, joined a party consisting of two other biologist divers and the field party chief at the USFWS Shellfish Laboratory in Milford, Connecticut. During the week 18-22 August 1958, each team of divers made an average of three dives per day. Qualitative and quantitative evaluations were made at least once, and in some cases twice, for each of the starfish control methods. All dives were made in water from 20 to 40 ft. deep; the majority were in water about 25 ft. deep.

The final results of the evaluations are to be reported on in detail by the Milford laboratory. This report is only a narration for the NAFI files at Woods Hole and presents only qualitative estimates of the efficiency of the devices.

Methods

Qualitative evaluations: The application of lime was evaluated by two divers (operating from the State of Connecticut R/V Shellfish) who sat on the bottom while the lime spreading boat passed overhead. A visual estimate was made of the percentage of starfish on which particles of lime had settled and the number of particles on each starfish.

The dredges and the mop were evaluated by two divers riding on the devices as they were towed on the bottom. The divers transferred at sea from the FWS vessel Shang Wheeler to the particular privately owned vessel which would tow the device under observation. The device was set out and the vessel stopped. At this point the divers entered the water and descended along the towing warp. By prearranged plan, the vessel commenced towing one minute after the divers had begun their descent.

Clinging to the device under tow, the divers watched its action on the bottom (i. e., did it bounce along the bottom, ride on the substrate or dig in?). The divers also watched to see if starfish were pushed out of the way, passed under the device or, in the case of the dredges, escaped through the meshes. The divers then dropped

off the device and swam back along the track of the tow to determine the effect of the dredge on the bottom and its effect on the bottom fauna and flora, where present.

Quantitative evaluations: Actual counts of starfish remaining in the tow path (treated area) and counts of starfish in an untreated control area parallel to the tow path were made with a line transect. The transect was established by the divers paying out a chain 50 yards long from the device under tow. A lead weight, a buoy and buoy line were attached to each end of the chain. The buoys enabled the diver-tender in a skiff to retrieve the chain at the end of the operation.

When the chain was set straight in the tow path, the divers swam along its length picking up all starfish in a path 18 inches on each side of the chain. Thus a strip 1 yard wide and 50 yards long was sampled. A control sample was obtained by moving the chain 5 to 10 feet away from, and parallel to, the treated area and repeating the starfish gathering operation. Each sample of starfish was placed in separate cotton bags and returned to the surface to be counted. The number of starfish from the treated area vs. the number from the untreated area gave a numerical index to the efficiency of each device.

The rate of movement of starfish was obtained by measuring the distance a starfish traveled under its own power in one minute. The starfish were timed by the special underwater watches worn by the Woods Hole divers.

When the divers surfaced they were picked up by the Shang Wheeler or by the skiff and returned to the Shang Wheeler. The field party chief interviewed each team of divers immediately following their dive. A questionnaire was used to obtain standardized information. Questions asked included those relative to: visibility, depth of water, animals or plants seen, estimate of degree of starfish infestation, effect of device on substrate, effect of device on animals and plants.

Results

Liming: The surface application of lime achieved a coverage of 80-85 percent of the starfish in the area. Each starfish hit had at least one granule of lime, about the size of a match head, on the aboral surface. Most of the starfish were hit by three to five lime granules.

Turtle dredge: This dredge, designed for capturing diamond back terrapins (hence the name), is approximately 8 feet wide, 3 feet high, and 4 feet deep. The iron frame is covered with welded wire having rectangular meshes 2 inches high and 4 inches wide. While on the bottom under tow, the dredge rides on four iron skids.

The turtle dredge was reasonably effective in picking up starfish. The cutter bar of the dredge did not dig into the bottom so a few starfish were passed over. A number of starfish escaped through the large meshes of the wire.

Mops: A starfish mop consists of an iron bar 8 to 10 feet long to which about 12 cotton mops 3 to 5 feet long are attached. A 1- or 2-foot length of chain connects the mops to the bar. In use, the mops are towed on the bottom and the starfish become entangled in the cotton yarn. When the mops are hauled back, they are immersed in vats of very hot water which kills the starfish.

No evaluation could be made by the Woods Hole divers because of the extreme turbidity of the water when the mop was towed. The tow area had a very soft mud substrate which boiled up in dense black clouds at the slightest disturbance. Visibility during this operation ranged from 3 inches to a maximum of 1 foot.

Suction dredge: Perhaps the most dramatic diving experience of the entire week's work was the evaluation of a suction dredge. This piece of gear was operated from a large wooden hulled scow about 100 feet long and 30 feet wide. Used in oyster harvesting, the suction dredge essentially is a pump and a combination rubber and metal hose about 18 inches in diameter ending in the suction head. The head, shaped like a vacuum cleaner, has a horizontal opening 8 feet long and 1 foot wide.

When the dredge is to be operated, the head is lowered to rest on the bottom. The pump is started and the scow moves ahead. Material collected passes through the head, up the hose, through the pipe and onto a screened shaker table. This table separates the water and fine material while live oysters, oyster shells and larger material move onto a long moving belt. Live

oysters are hand picked from the belt and the remaining material drops into bins on the deck. Starfish picked up by the dredge are limed and dumped overboard.

To say the suction dredge is 100 percent efficient would be an understatement. The dredge sucks up everything in its path including the substrate to a depth of 3 inches. Nothing is left behind, and no starfish escape over the top or around the sides of the dredge.

Prior to making the evaluation, the divers were somewhat apprehensive about the possibility of having an arm or a leg drawn up into the dredge head. However, once they were under way on the bottom, it became apparent that it would be necessary to be in the direct path to be affected by the suction of the dredge. A continuous rain of broken shells, sand, and gravel fell on the divers from the material dumped over the side of the scow.

Visibility during this operation was the best of any during the entire week's work. Most of the time the divers could see an average distance of 15 feet horizontally, and the visibility was not diminished by the material raining down from the scow.

Standard oyster dredge: The dredge observed by the divers was the type commonly used to harvest oysters. It consisted of an iron frame with an opening 4 feet wide and 2 feet high to which was attached a bag made of iron rings. Teeth attached to a bar across the lower edge of the opening served to loosen and lift oysters from the bottom.

The evaluation tow was made on a rippled sandy bottom which caused the dredge bag to fill with sand during the first few minutes of towing. However, the bag soon emptied itself, and the dredge moved rapidly across the bottom without further hindrance.

Few starfish were captured while the dredge was filled with sand, but when it emptied the dredge became very efficient.

Sampling dredge: The last piece of gear evaluated was the sampling dredge used aboard the Shang Wheeler for obtaining samples of oysters, starfish, and other bottom forms. Three separate dives were made before a successful evaluation run could be made. Scarcity of starfish in one area and too rapid a speed over the bottom in another area were the principal problems encountered in the first two dives. The third dive was successful, and the dredge was observed to be efficient in capturing starfish.

During the third run, the transect chain became entangled as it was being paid out. The time involved in straightening out the chain was such that one diver exhausted his air supply and returned to the surface. The other diver also returned to the surface, thus ending this phase of the operations. No further dives were made by the Woods Hole divers.

Rate of starfish movement: Four measurements were made to measure the rate at which starfish moved across the bottom. The speeds ranged from 5 inches to 8 inches per minute and averaged 6 inches per minute.

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